

WE CLAIM:

1. A method of inhibiting microbial growth in a well comprising:
providing a well bore;
mixing a first material and an antimicrobial agent to form a packing material
filling at least a portion of the well bore with the packing material.
2. The method of claim 1 wherein the antimicrobial agent is a solid, and wherein the packing material comprises from about 0.5% antimicrobial agent to about 30% antimicrobial agent, by volume.
3. The method of claim 1 wherein the first material comprises at least one of sand or gravel.
4. The method of claim 1 wherein the well comprises a casing within the well bore, the casing being at least partially surrounded by an annular space, and wherein the filling at least part of the well bore comprises filling at least part of the annular space.
5. The method of claim 1 wherein the casing comprises a screened portion within the well bore, and wherein the filling of at least a portion of the well bore comprises filling the annular space to at least cover the screened portion of the casing.

6. The method of claim 1 further comprising;
after filling at least a portion of the well bore with the packing material,
filling at least a portion of the well bore with a filler material.
7. The method of claim 1 wherein the providing the well bore comprises
providing a well bore that extends into the saturated-zone.
8. The method of claim 1 wherein the providing the well bore comprises
providing a well bore that extends into the vadose-zone.
9. A method of inhibiting microbial growth in a well comprising:
providing a well bore, the well bore having a depth extending from a
ground surface;
providing at least one access tube within the well bore; and
supplying an antimicrobial material into the well through the first terminal
opening of the at least one access tube.
10. The method of claim 9 wherein the providing the at least one access tube
comprises providing from about 2 to about 10 access tubes.

11. The method of claim 9 further comprising providing a casing within the well bore, the casing being at least partially surrounded by an annular space, wherein the at least one access tube is provided outside the casing and within the annular space.

12. The method of claim 11 wherein the providing the at least one access tube comprises distributing from about 2 to about 10 access tubes around a circumference of the casing.

13. The method of claim 12 wherein the distributing the access tubes comprises equally spacing the access tubes around the casing.

14. The method of claim 9 wherein the providing the at least one access tube comprises providing access tubes having a perforated segment extending from a second terminal opening, the second terminal opening being within the well bore, and wherein the second terminal opening is capped.

15. The method of claim 9 wherein the supplying the antimicrobial agent comprises supplying the antimicrobial agent at time intervals.

16. The method of claim 15 wherein the time intervals are from between about 2 months and about 12 months.

17. The method of claim 15 further comprising:

reversibly capping the first terminal opening of the at least one access tube during the time interval between the supplying of the antimicrobial agent.

18. The method of claim 9 wherein the supplying the antimicrobial agent comprises supplying one or more of a chlorine release compound, an antimicrobial amine, or a metal inhibitor.

19. The method of claim 18 wherein the supplying the antimicrobial agent comprises supplying a chlorine release compound wherein chlorine is released when the compound reacts with water.

20. The method of claim 9 wherein the supplying the antimicrobial agent comprises supplying one or more of a powder form, a tablet form, a granular form, or a pellet form.

21. The method of claim 9 wherein the supplying the antimicrobial agent comprises supplying at least some of the antimicrobial agent in an encapsulated form.

22. The method of claim 9 wherein the supplying the antimicrobial agent through the first terminal opening comprises pressure pumping one or both of a gas antimicrobial agent and a liquid antimicrobial agent through the first terminal opening.

23. The method of claim 9 wherein the supplying the antimicrobial agent through the first terminal opening comprises pushing one or both of a gas antimicrobial agent and a liquid antimicrobial agent through the first terminal opening with a pressurized air stream.

24. The method of claim 9 wherein the providing the well bore having a depth extending from the ground surface comprises providing a well bore having a depth that extends into the saturated-zone.

25. The method of claim 9 wherein the providing a well bore having a depth extending from the ground surface comprises providing a well bore having a depth that extends into the vadose-zone.

26. The method of claim 9 further comprising:

providing a layer of packing material to an elevation within the well bore to at least partially fill the well bore, wherein the at least one access tube extends to below the elevation of the layer.

27. The method of claim 26 wherein the providing the at least one access tube comprises providing access tubes having a perforated segment, and wherein the elevation of the layer of packing material is above the perforated segment of the access tubes.

28. The method of claim 26 further comprising:

formation of the packing material, the formation comprising mixing an antimicrobial agent with one or both of sand and gravel.

29. A method of forming a well packing material comprising:

mixing an antimicrobial agent with one or both of sand and gravel, wherein the antimicrobial agent comprises one or more of a dissolved form, a powdered form, a granular form, a pellet form, and a tablet form; and wherein the antimicrobial agent content in the packing material is from about 0.5% to about 30%, by volume.

30. The method of claim 29 wherein at least some of the antimicrobial agent is encapsulated.

31. The method of claim 29 wherein the antimicrobial agent comprises one or more of a chlorine release compound, an antimicrobial amine, and a metal inhibitor.

32. The method of claim 29 wherein the antimicrobial agent comprises a powdered form and wherein the mixing comprises coating the one or more of sand and gravel with the powdered form.

33. The method of claim 29 wherein the antimicrobial agent comprises a dissolved form, the method further comprising;

adding a solution comprising the dissolved form of antimicrobial agent to the one or both of sand and gravel, wherein the mixing comprises mixing the one or more of sand or gravel with the solution; and

forming a precipitate from the dissolved form of antimicrobial agent, wherein the precipitate forms a coating on the one or more of sand and gravel.

34. A microbial growth inhibiting material comprising:

at least one of sand or gravel; and

an antimicrobial agent, wherein the antimicrobial agent comprises one or more of a precipitate form, a powder form, a tablet form, a granular form, and a pellet form, and comprises one or more of a chlorine releasing compound, an antimicrobial metal, and an antimicrobial amine.

35. The material of claim 34 wherein the antimicrobial agent comprises one or more of a precipitate form and a powder form, and wherein the at least one of sand or gravel is coated with one or both of the precipitate and the powder.

36. The material of claim 34 wherein at least some of the antimicrobial agent is delayed release.

37. The material of claim 34 wherein the antimicrobial agent comprises a chlorine releasing compound selected from the group consisting of calcium hypochlorites, trichloroisocyanurate, dichloroisocyanurate.

38. The material of claim 34 wherein the antimicrobial agent comprises an antimicrobial metal selected from the group consisting of silver, copper and zinc

39. The material of claim 38 wherein the antimicrobial agent comprises an antimicrobial amine, wherein the antimicrobial amine is selected from the group consisting of quaternary ammonia compounds and N-halamines.

40. The material of claim 34 wherein the at least some of the antimicrobial agent is encapsulated.

41. A well comprising:
a well bore; and
a layer of packing material within the well bore, wherein the layer of packing material comprises a mixture of an antimicrobial agent and one or more of sand and gravel, the mixture having an antimicrobial agent content of from about 0.5% to about 30%, by volume.

42. The well of claim 41 further comprising:

a casing within the well bore, wherein the casing comprises a screened portion;

an annular space around at least part of the casing, wherein the layer of packing material within the bore is within the annular space and at least partially covers the screened portion of the casing.

43. The well of claim 42 wherein the layer of packing material entirely covers the screened portion of the casing.

44. A well comprising:

a well bore;

one or more access tubes within the well bore; and

an antimicrobial agent within the well bore, the antimicrobial agent being added through the access tubes.

45. The well of claim 44 further comprising a well casing within the well bore.

46. The well of claim 44 wherein the antimicrobial agent comprises one or both of a liquid and a gas.

47. The well of claim 44 wherein the antimicrobial agent comprises one or more of a powder form, a tablet form, a granular form and a pellet form.

48. The well of claim 44 wherein the one or more access tubes have a diameter of from about 0.25 inches to about 1.5 inches.

49. The well of claim 44 further comprising a well casing, and wherein the one or more access tubes encircle the casing and are spaced equally with respect to each other.

50. The well of claim 49 wherein the antimicrobial agent comprises a first antimicrobial agent and wherein the well construction further comprises a layer of packing material within the well bore, the layer of packing material comprising a second antimicrobial agent.

51. The well of claim 50 wherein the second antimicrobial agent is different from the first antimicrobial agent.

52. The well of claim 44 wherein the well bore extends into the saturated-zone.

53. The well of claim 44 wherein the well bore extend into the vadose-zone.

54. A well having inhibited microbial growth comprising:

a well bore;

a well casing within the well bore, the casing having a terminal end within the well bore and having a screened portion extending from the terminal end to a first elevation within the bore;

multiple access tubes, the access tubes being within the well bore and encircling the casing, the access tubes having a first terminal opening and a second terminal opening, the second terminal opening being within the well bore, and having a perforated segment extending from the second terminal opening to a second elevation within the well bore;

a layer of packing material within the well bore, wherein the packing layer comprises a mixture of a first antimicrobial agent and one or more of sand and gravel and fills the bore to a third elevation within the bore and wherein the mixture was mixed prior to formation of the layer; and

a second antimicrobial agent within the access tubes, the second agent being able to pass from within the access tubes into the layer of packing material through the perforated segment of the access tubes.

55. The well of claim 54 wherein the third elevation is greater than the first and the second elevation.

56. The well of claim 54 wherein the second antimicrobial is added through the first terminal opening, and wherein the second antimicrobial comprises one or both of a gas and a liquid.

57. The well of claim 56 wherein the one or both of a gas and a liquid are pumped through the first terminal opening of the access tubes.

58. The well of claim 56 wherein the one or both of a gas and a liquid are pushed through the access tubes and into the layer of packing material by a pressurized air stream flowed through the first terminal opening of the access tubes.

59. The well of claim 56 wherein the one or both of a gas and a liquid are pushed through the access tubes and into the layer of packing material by inserting a slotted tube through the first terminal opening of the access tubes to sift the antimicrobial agent through the perforated segment of the access tubes.